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European Technical Assessment

**ETA-17/0874
of 28/12/2018**

General Part

Technical Assessment Body issuing the European Technical Assessment

Instytut Techniki Budowlanej

Trade name of the construction product

R-KER-II-S
for rebar connections

Product family to which the construction product belongs

Post-installed rebar connections with R-KER-II-S injection mortar

Manufacturer

RAWLPLUG S.A.
ul. Kwidzyńska 6
51-416 Wrocław
Poland

Manufacturing plant

Manufacturing plant nr 3

This European Technical Assessment contains

19 pages including 3 Annexes which form an integral part of this Assessment

This European Technical Assessment is issued in accordance with regulation (EU) No 305/2011, on the basis of

EAD 330087-00-0601 "Systems for post-installed rebar connections with mortar"

This version replaces

ETA-17/0874 issued on 29/03/2018

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Specific Part

1 Technical description of the product

The subject of the assessment are the post-installed rebar connections, by anchoring or overlap connection joint, of steel reinforcing bars (rebars) in existing structures made of normal weight concrete, using injection mortar R-KER-II-S in accordance with the regulations for reinforced concrete construction.

Steel reinforcing bars of diameter from 8 to 40 mm and R-KER-II-S injection mortar are used for the post-installed rebar connections. The reinforcing bar is placed into a drilled hole previously filled with injection mortar and is anchored by the bond between embedded element, injection mortar and concrete.

The product description is given in Annex A.

2 Specification of the intended use in accordance with the applicable European Assessment Document (EAD)

The performances given in Section 3 are only valid if the post-installed rebar connections are used in compliance with the specifications and conditions given in Annex B.

The performances given in this European Technical Assessment are based on an assumed working life of the rebar connection of 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer or the Technical Assessment Body, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to the methods used for its assessment

3.1 Performance of the product

3.1.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance under static and quasi-static loading	See Annex C

3.1.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	The post-installed rebar connection satisfies requirements for Class A1
Resistance to fire	No performance assessed

3.2 Methods used for the assessment

The assessment of the post-installed rebar connections has been made in accordance with the EAD 330087-00-0601 "Systems for post-installed rebar connections with mortar".

4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

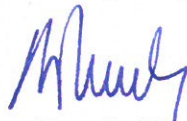
According to the Decision 96/582/EC of the European Commission the system 1 of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) applies.

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document (EAD)

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at Instytut Techniki Budowlanej.

For type testing the results of the tests performed as part of the assessment for the European Technical Assessment shall be used unless there are changes in the production line or plant. In such cases the necessary type testing has to be agreed between Instytut Techniki Budowlanej and the notified body.

Issued in Warsaw on 28/12/2018 by Instytut Techniki Budowlanej



Anna Panek, MSc
Deputy Director of ITB

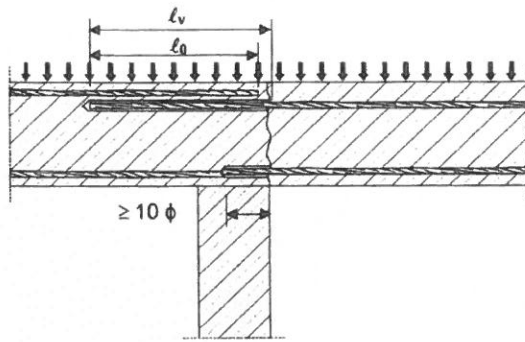


Figure A1 Overlap joint for rebar connections of slabs and beams

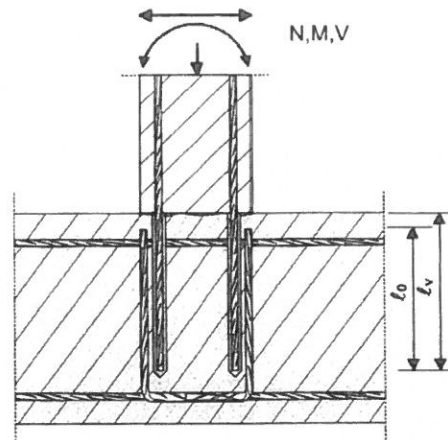


Figure A2 Overlap joint at a foundation of a column or wall where the rebar is stressed in tension

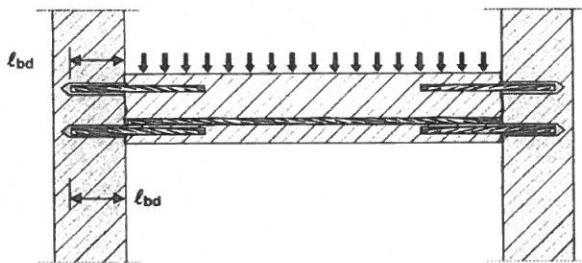


Figure A3 End anchoring of slabs or beams, designed as simply supported

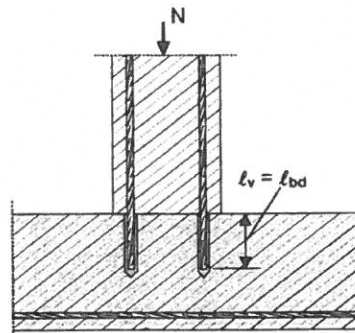
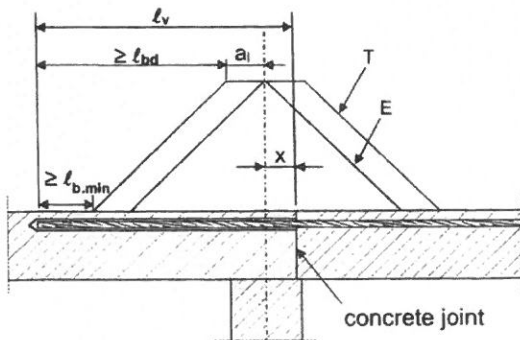


Figure A4 rebar connection for components stressed primarily in compression; rebar is stressed in compression



(only post-installed rebar is plotted)

Figure A5 Anchoring of reinforcement to cover the line of acting tensile force

Key to Figure A5

- T acting tensile force
- E envelope of $M_{ed}/z + N_{ed}$ (see EN 1992-1-1, Figure 9.2)
- x distance between the theoretical point of support and concrete joint

Note to Figure A1 to A5

In the Figures no transverse reinforcement is plotted, the transverse reinforcement as required by EN 1992-1-1 shall be present.

The shear transfer between old and new concrete shall be designed according to EN 1992-1-1.

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for rebar connections**

Installed condition: application examples of post-installed rebar.

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<p>Coaxial cartridge</p> <p>Side by side cartridge</p> <p>Cartridge for two part foil capsule within a single components</p> <p>Mixer Nozzle for Cartridge (R-NOZ-KER-II)</p> <p>Foil capsule – cartridge free system (CFS system)</p> <p>Mixer for foil capsules (CFS system)</p> <p>Mixer CFS+ for foil capsules</p>	
<p>R-KER-II-S for rebar connections</p>	<p>Annex A2 of European Technical Assessment ETA-17/0874</p>
<p>Product description</p>	

Table A1: Injection mortar

Designation	Composition
R-KER-II-S (Injection mortar)	Additive: quartz Bonding agent: vinyl ester resin styrene free Hardener: dibenzoyl peroxide

Table A2: Rebar

Designation	Rebar
Rebar according to EN 1992-1-1, Annex C, Table C.1 and C.2N	Bars and de-coiled rods Class B or C Minimum relative rib area, $f_{R,min}$, according to EN 1992-1-1 The rib height h : $h \leq 0,07 \cdot \varnothing$

R-KER-II-S for rebar connections	Annex A3 of European Technical Assessment ETA-17/0874
Materials	

SPECIFICATION OF INTENDED USE

Anchorage subject to:

Static and quasi-static loads.

Base material:

- Reinforced or unreinforced normal weight concrete of strength class C12/15 at minimum to C50/60 at maximum according to EN 206.
- Maximum chloride content of 0,40% (Cl 0,40) related to the cement content according to EN 206.
- Non-carbonated concrete.

Note: In case of a carbonated surface of the existing concrete structure the carbonate layer shall be removed in the area of the post-installed rebar connection with a diameter of $d_s + 60$ mm prior to the installation of the new rebar. The depth of concrete to be removed shall correspond to at least the minimum concrete cover according to EN 1992-1-1.

The above may be neglected if building components are new and not carbonated and if building components are in dry conditions.

Temperature in the base material:

At installation:

- +5°C to +50°C

In service:

- -40°C to +120°C (max. short term temperature +120°C and max. long term temperature +70°C).

Use conditions (environmental conditions):

- Structures subject to dry internal conditions.
- Structures subject to external atmospheric exposure including industrial and marine environment.
- Structures subject to permanently damp internal conditions if no particular aggressive conditions exist.

Note: Particular aggressive conditions are e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with extreme chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used).

Design:

- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking into account of the forces to be transmitted.
- Design according to EN 1992-1-1 and Annex B2.
- The actual position of the reinforcement in the existing structure shall be determined on the basis of the construction documentation and taken into account when designing.

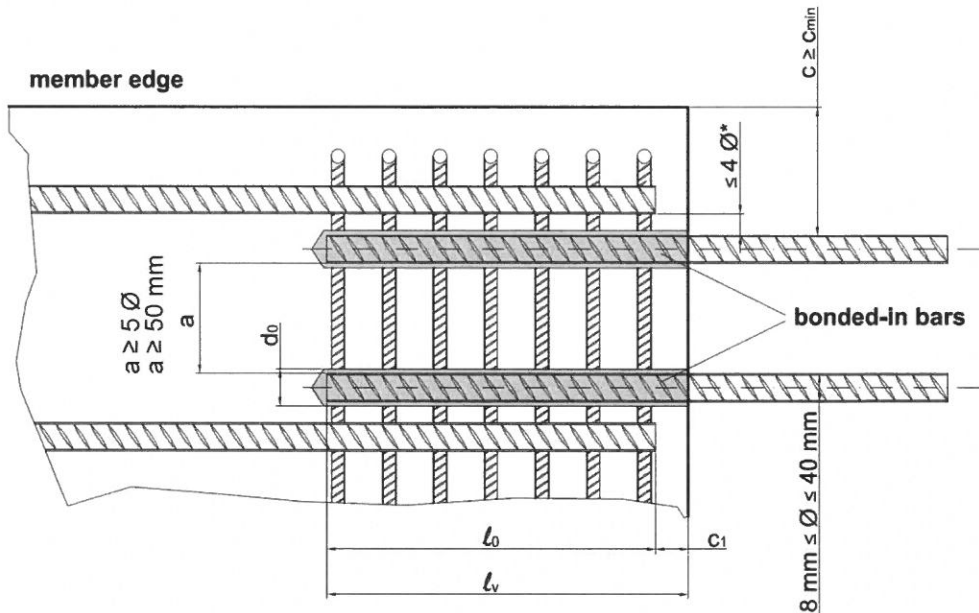
Installation:

- Dry or wet concrete (use category 1).
- It must not be installed in flooded holes.
- Overhead installation is permissible.
- Hole drilling by hammer drilling with hollow drill bit.
- Installation of the post-installed rebar shall be done only by suitable trained installer and under supervision on the site.
- Check the position of the existing rebar (if the position of existing rebars is not known it shall be determined using a rebar detector suitable for this purpose as well as on the basis of the construction documentation and then marked on the building component for the overlap joint).

<p>R-KER-II-S for rebar connections</p>	<p>Annex B1 of European Technical Assessment ETA-17/0874</p>
<p>Intended use – specifications</p>	

General design rules of construction for post-installed rebar

- Only tension forces in the axis of the rebar may be transmitted.
- The transfer of shear forces between new concrete and existing structure shall be designed additionally according to EN 1992-1-1.
- The joints for concreting must be roughened to at least such an extent that aggregate protrude.



* If the clear distance between overlapping rebar is greater than $4 \cdot \emptyset$ the overlap length shall be enlarged by the difference between the clear distance and $4 \cdot \emptyset$.

- l_0 – lap length acc. to EN 1992-1-1, clause 8.7.3
- l_v – effective embedment depth; $l_v \geq l_0 + c_1$
- c – concrete cover of post-installed rebar
- c_{min} – minimum concrete cover acc. to Annex B3 and EN 1992-1-1, clause 4.4.1.2.
- c_1 – concrete cover at end-face of existing rebar
- d_0 – nominal drill bit diameter acc. to Annex B3
- \emptyset – rebar diameter (d_s)

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Intended use – general construction rules for post-installed rebar	

Table B1: Installation data – hammer drilling

Size of rebar	ø8	ø10	ø12	ø14	ø16	ø20	ø25	ø28	ø32	ø40
Drill bit diameter [mm]	12	14	16	18	20	25	30	35	40	50
Brush diameter [mm]	14	16	18	20	22	27	32	37	42	52
Minimum anchoring rebar $l_{b,min}$ [mm]	115	145	170	200	230	285	355	400	455	570
Minimum overlap joint $l_{o, min}$ [mm]	200	215	255	300	340	430	540	600	690	860
Maximum anchoring rebar $l_{v,max}$ [mm]	400	500	600	700	800	1000	1200	1400	1500	1000

* for diameter from ø20 to ø40 mm all installation over 700 mm depth has to be done with a cartridge stored at +20°C

Note:

$l_{b,min}$ (or $l_{v,min}$) = α_{lb} x max {0,3 x $l_{b,rqd}$; 10ø; 100 mm} for ø8 to ø40

$l_{o,min}$ (or $l_{v,min}$) = α_{lb} x max {0,3 x α_6 x $l_{b,rqd}$; 15ø; 200 mm} for ø8 to ø40

with: yield stress for rebar 500 N/mm²; $\gamma_M = 1,15$; $\alpha_6 = 1,5$; concrete C20/25 and $f_{bd} = 2,3$ N/mm² (good bond conditions)

Minimum concrete cover (see Annex B2):

$c_{min} = 30$ mm + 0,06 · $l_v \geq 2\phi$ for $\phi < 25$ mm

$c_{min} = 40$ mm + 0,06 · $l_v \geq 2\phi$ for $\phi \geq 25$ mm

The minimum concrete cover according to EN 1992-1-1 shall be observed.

Minimum clear spacing between two post-installed rebar:

$a \geq 50$ mm

$a \geq 5\phi$

Table B2: Processing time and minimum curing time

Temperature of resin [C°]	Temperature of substrate [C°]	Processing time [min.]	Minimum curing time [min.]
5	5	40	720
10	10	20	480
15	15	15	360
20	20	10	240
25	25	9,5	180
25	30	7	120
25	35	6,5	120
25	40	6,5	90
25	45	6	60
25	50	5	30

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Installation data, processing time and curing time

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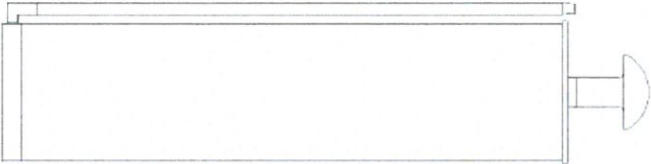
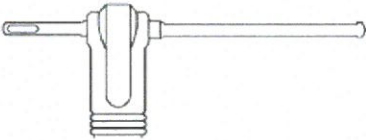



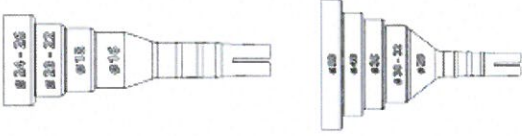

<p>Manual blow pump R-BLOWPUMP</p>  <p>Hollow drill bit</p>  <p>Steel brush R-BRUSH</p>  <p>Steel brush with extension R-BRUSH-T</p>  <p>Mixer nozzle extension R-NOZ-EXT</p>  <p>Dosing plug R-NOZ-P</p>  <p>Temporary positioning wedge</p> 	
<p>R-KER-II-S for rebar connections</p>	<p>Annex B4 of European Technical Assessment ETA-17/0874</p>
<p>Tools for installation (1)</p>	

Table B3: Brushes for cleaning the drilled holes (steel wires)

Rebar diameter [mm]		ø8	ø10	ø12	ø14	ø16	ø20	ø25	ø28	ø32	ø40
Type of the brush		Steel									
Nominal drill bit diameter	[mm]	12	14	16	18	20	25	30	35	40	50
Brush head diameter	[mm]	14	16	18	20	22	27	32	37	42	52

Table. B4: Dosing plug R-NOZ-P size

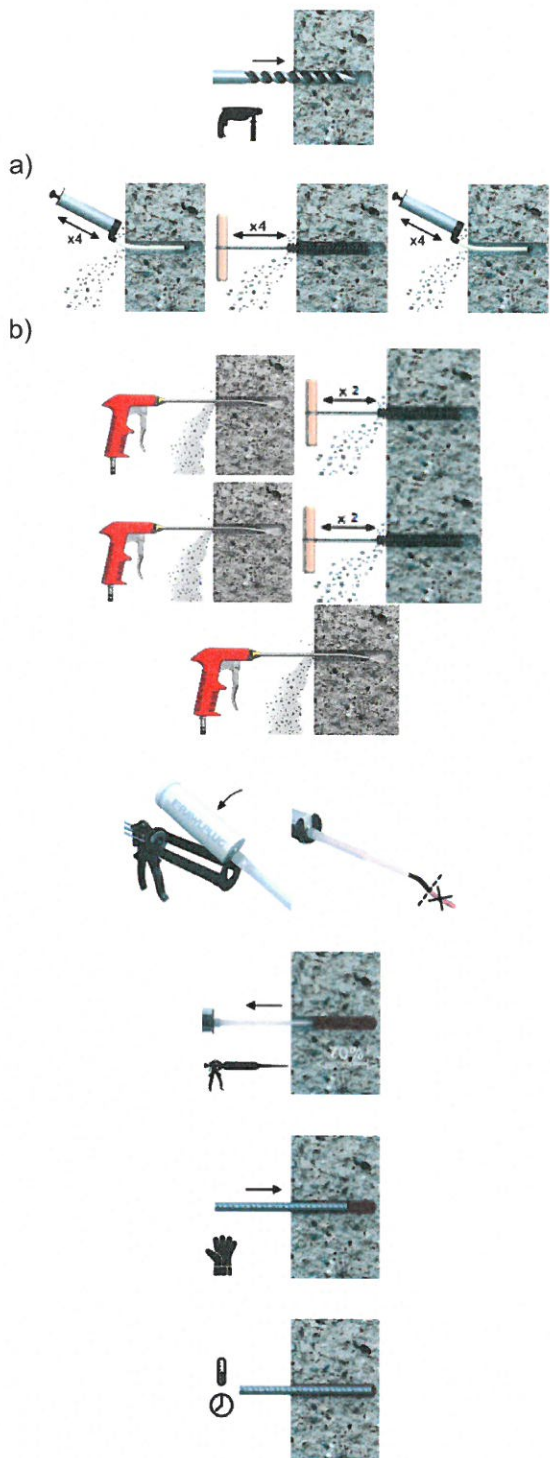
Rebar diameter [mm]	ø16	ø18	ø20	ø25	ø28	ø32	ø 35	ø40	ø50
Dosing plug R-NOZ-P description	ø16	ø18	ø20	ø24 – ø26	ø28	ø32	ø35	ø40	ø50

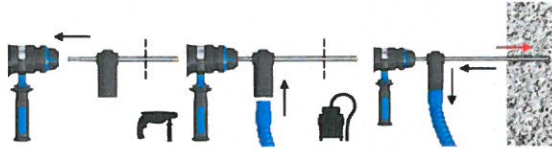
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Tools for installation (2)

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Dispersers	Cartridge or foil capsule size
 <p>Manual gun for coaxial cartridges</p>	380, 400, 410 and 420 ml
 <p>Manual gun for side by side cartridges</p>	345 ml
 <p>Manual gun for foil capsule in cartridge and coaxial cartridges</p>	150, 175, 280, 300 and 310 ml
 <p>Manual gun for foil capsules CFS+</p>	300 to 600 ml
 <p>Cordless dispenser gun for coaxial cartridges</p>	380, 400, 410 and 420 ml
 <p>Cordless dispenser gun for foil capsules</p>	300 to 600 ml
 <p>Pneumatic gun for coaxial cartridges</p>	380, 400, 410 and 420 ml
<p>R-KER-II-S for rebar connections</p>	<p>Annex B6 of European Technical Assessment ETA-17/0874</p>
<p>Tools for installation (3)</p>	

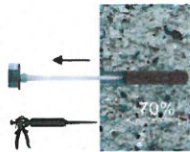
 <p>The diagram illustrates the installation process in six main steps:</p> <ol style="list-style-type: none"> Drilling: A rotary percussive machine is used to drill a hole into a concrete surface. Hole cleaning: <ol style="list-style-type: none"> Brush and hand pump: A brush is used to clean the hole from the bottom, with the hand pump blowing air through it. This is repeated 4 times (x4). Compressed air: A red air gun is used to blow the hole from the bottom, with the brush being used again. This is repeated 2 times (x2). Dispenser preparation: A cartridge of resin is inserted into a dispenser, and a nozzle is attached. Resin injection: The mixing nozzle is inserted into the hole, and resin is injected while the nozzle is slowly withdrawn to fill the hole to 2/3 of its depth. Rebar insertion: A rebar is inserted into the hole with a slight twisting motion. Excess resin is removed. Curing: The installation is left undisturbed until the curing time has elapsed. 	<ol style="list-style-type: none"> 1. Drill hole to the required diameter and depth using a rotary percussive machine. 2. Hole cleaning. <ol style="list-style-type: none"> a) Cleaning hole with brush and hand pump: <ul style="list-style-type: none"> - starting from the drill hole bottom blow the hole at least 4 times using the hand pump, - using the specified brush, mechanically brush out the hole at least 4 times, - starting from the drill hole bottom, blow at least 4 times with the hand pump. b) Cleaning hole with compressed air: <ul style="list-style-type: none"> - starting from the drill hole bottom blow the hole at least twice by compressed air 6 atm, - using the specified brush, mechanically brush out the hole at least twice, - blow the hole at least twice by compressed air 6 atm, - brush out the hole at least twice, - blow over the hole at least twice by compressed air 6 atm. 3. Insert cartridge into dispenser and attach nozzle. Dispense to waste until even colour is obtained (min. 10 cm). 4. Insert the mixing nozzle to the far end of the hole and inject resin, slowly withdrawing the nozzle as the hole is filled to 2/3 of its depth. 5. Immediately insert the rebar, slowly and with slight twisting motion. Remove any excess resin around the hole before it sets. 6. Leave the fixing undisturbed until the curing time elapses.
<p style="text-align: center;">R-KER-II-S for rebar connections</p>	<p style="text-align: center;">Annex B7</p>
<p style="text-align: center;">Installation instruction – standard cleaning</p>	<p style="text-align: center;">of European Technical Assessment ETA-17/0874</p>



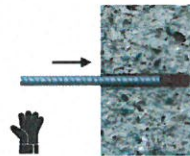
1. Drill hole to the required diameter and depth using a hollow drill bit with vacuum cleaner.



2. Insert cartridge into dispenser and attach nozzle. Dispense to waste until even colour is obtained (min. 10 cm).



3. Insert the mixing nozzle to the far end of the hole and inject resin, slowly withdrawing the nozzle as the hole is filled to 2/3 of its depth.



4. Immediately insert the rebar, slowly and with slight twisting motion. Remove any excess resin around the hole before it sets.

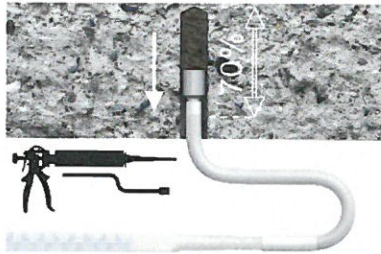


5. Leave the fixing undisturbed until the curing time elapses.

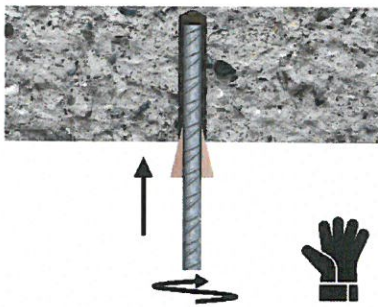
**R-KER-II-S
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Installation instruction – cleaning when hollow drill bit with vacuum cleaner is used (special cleaning method)

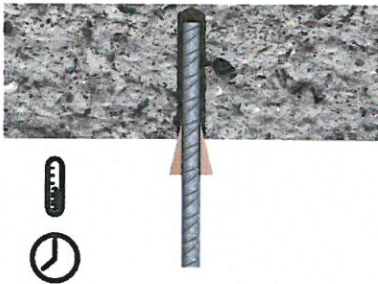
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1. Inject from the bottom of the hole. Inject the product about 2/3 of the hole depth. Use extension and appropriately sized piston plug assembled on the mixer.



2. Drive the rebar immediately into the hole. Use temporary interlocking element e.g wedges.



3. Leave the fixing undisturbed until the curing time elapses. To avoid the slipping of the rebar during the open time of the product (due to the rebar own weight) use a temporary interlocking element.

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Installation instruction – overhead installation

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Table C1: Amplification factor α_{lb}

The minimum anchorage length $l_{b,min}$ and the minimum lap length $l_{o,min}$ according to EN 1992-1-1 shall be multiplied by the relevant amplification factor α_{lb} in table C1.

Rebar diameter [mm]	Concrete strength class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ø8	1	1	1	1	1	1	1	1	1
ø10	1	1	1	1	1	1	1	1	1
ø12	1	1	1	1	1	1	1	1	1
ø14	1	1	1	1	1	1	1	1	1
ø16	1	1	1	1	1	1	1	1	1
ø20	1	1	1	1	1	1	1	1	1
ø25	1	1	1	1	1	1	1	1	1
ø28	1	1	1	1	1	1	1	1	1
ø32	1	1	1	1	1	1	1	1	1
ø40	1	1	1	1	1	1	1	1	1

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Amplification factor α_{lb}

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Table C2: Bond efficiency value k_b

Bar diameter [mm]	Concrete strength class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ø8	1	1	1	1	1	1	1	1	1
ø10	1	1	1	1	1	1	1	1	1
ø12	1	1	1	1	1	1	1	1	0,93
ø14	1	1	1	1	1	1	1	0,92	0,93
ø16	1	1	1	1	1	1	1	0,92	0,86
ø20	1	1	1	1	1	1	0,91	0,84	0,86
ø25	1	1	1	1	1	0,90	0,82	0,84	0,79
ø28	1	1	1	1	1	0,90	0,82	0,76	0,79
ø32	1	1	1	1	0,89	0,90	0,82	0,76	0,71
ø40	1	1	0,86	0,74	0,66	0,59	0,63	0,58	0,54

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Bond efficiency value k_b

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Table C3: Design values of the ultimate bond resistance $f_{bd}^{(1)}$ in N/mm²

Rebar diameter [mm]	Concrete strength class								
	C12/15	C16/20	20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ø8	1,60	2,00	2,30	2,70	3,00	3,40	3,70	4,00	4,30
ø10	1,60	2,00	2,30	2,70	3,00	3,40	3,70	4,00	4,30
ø12	1,60	2,00	2,30	2,70	3,00	3,40	3,70	4,00	4,00
ø14	1,60	2,00	2,30	2,70	3,00	3,40	3,70	3,70	4,00
ø16	1,60	2,00	2,30	2,70	3,00	3,40	3,70	3,70	3,70
ø20	1,60	2,00	2,30	2,70	3,00	3,40	3,40	3,40	3,70
ø25	1,60	2,00	2,30	2,70	3,00	3,00	3,00	3,40	3,40
ø28	1,60	2,00	2,30	2,70	3,00	3,00	3,00	3,00	3,40
ø32	1,60	2,00	2,30	2,70	2,70	3,00	3,00	3,00	3,00
ø40	1,60	2,00	2,00	2,00	2,00	2,00	2,30	2,30	2,30

¹⁾ According to EN 1992-1-1 for good bond conditions.
For all other bond conditions multiply the value by 0,7.

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Design values of the ultimate bond resistance f_{bd}

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